REPORT OF THE COMMITTEE ON POLLUTION OF DRINKING WATER SOURCES - 1984

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1. INTRODUCTION

1.1 This Committee was appointed by the S/L.G., H & C. by his letter dated 28th September 1982. The Committee had to examine pollution of drinking water sources and report thereon broadly under three headings, namely -

(1) The nature and extent of existing pollution of drinking water sources in Sri Lanka, and possible new sources of pollution arising from investment programmes under implementation or planned:

(2) The standards that should be adopted to control pollution of drinking water sources:

(3) The existing legal provisions, institutional arrangements and facilities for such control of pollution of drinking water sources, their adequency and improvements or changes suggested for proper implementation of standards.

1.2 The Committee considered it important that a representative from the Agriculture Dept. should also be in the Committee. Accordingly Dr. S. Nagarajah, Chemist of the Department of Agriculture was nominated as a member of the Committee.

1.3 The Committee also considered that a comprehensive survey of existing pollution of drinking water sources, and a study of likely pollution arising from investment programmes under implementation or planned, would be time-consuming and expensive. It was decided therefore that while surveys and studies should be continued, the Committee should examine only recommendations on standards and on measures to be taken to control pollution of drinking water sources.

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2. STUDY OF POLLUTION OF DRINKING WATER SOURCES

2.1 Industrial pollution

2.1.1. Studies previously done

The Committee examined studies of industrial pollution so far done. The CISIR has provided a summary of analytical data on effluents from local factories, which included the following-

Milk Processing Plant
Paper and Pulp Processing Plant
Milk Powder Manufacturing Plant
Textile Mill
Paint Factory.

This analytical data is shown in Annex I. The CISIR has also provided some analytical data pertaining to water quality of some surface waters receiving industrial effluents. This included the following -

Puthueli Aru, Valachchenai	(29th April - 3rd May 1980)
Wellawatte Canal, Colombo	(11th Feb. 1981)
Kelani River	(16th March 1982)

These data are given in Annexes II, III, IV. The NARA has done a study of industrial pollution of aquatic habitats in the Jaela-Ekala area, which is affected by Ekala Industrial Estate. Samples have been collected at seven stations and this analytical data is at Annex V. The Committee also made use of the studies done by the Committee which examined the water pollution impact of the second IPZ at Biyagama, the studies done on the fish deaths in the Kelani Ganga in mid September 1982, and the report of the CISIR on the siting of industries with reference to pollution harzards submitted to the Local Investment Approval Committee of the Ministry of Industries & Scientific Affairs.

2.1.2 The Committee examined the various forms of industrial pollution and noted the following forms -

i) Thermal pollution which is caused by discharge of heated effluents from industry and power generating stations. As biological reactions are accellerted at higher temperatures, the dissolved oxygen in water is consumed by these reactions much faster. Furthermore at higher temperatures the solubility of atmospheric oxygen in water is reduced.

ii) Addition of untreated sewage to water. This creates a serious health hazard.

iii) Addition of synthetic pollutant like chlorinated hydrocarbons, detergents, dyes etc. Such synthetics could cause poisoning of aquatic and human life, or could retard process of natural purification of water ways.

iv) Oil pollution, which may not only seriously affect aeration of the water way, but could add toxic compounds and prevent its use as a source for drinking water and could affect fish, plankton etc.

v) Addition of large quantities of inert, insoluble material. This could seriously affect aquatic life and destroy the bottom flora in the water way.

vi) Addition of organic solids which degrade slowly (e.g. paper factory effluent), and affect the dissolved oxygen content.

vii) Addition of readily degradable organic matter. This will seriously affect the dissolved oxygen content, and may even temporarily remove it completely.

viii) Addition of toxic metals and other inorganic residues. These could cause acute poisoning of aquatic and human life.

2.1.3. Based on the examination of the previous studies, the Committee noted that industrial pollution of drinking water sources has been a hazard in the past, and is likely to be more hazardous with the expansion of industrial development. In working out the methods and procedures for control of industrial pollution of drinking water sources, the Committee considered the following points should be borne in mind -

(a) Industrial development should not be unduly hampered by the controls brought on industrial pollution:

(b) The institutional arrangements and the facilities available for implementing any system of controls effectively must be taken into account:

(c) The possibility of siting industries in certain areas where their pollution impact is minimised, and the application of pollution standards less stringently in such cases should be considered:

(d) It is desirable to commence with standards that are at a minimum consistent with safety of drinking water source.

2.1.4. Classification of industries according to pollution level

The Committee has taken the above points into consideration when working out standards. The Committee has also examined a classification of industries according to their level of pollution. Broadly the Committee considered four such categories as follows -

i) Very low level of pollution - e.g. bicycle repair workshop, blacksmith, gem cutting, ice making.

ii) Low level of pollution - e.g. manufacture of ice-cream, leather products from tanned leather, paper products, wood products, bricks, electronic lighting fittings, wire nails, paper clips, etc, as well as printing presses, vehicle repair workshops, and grinding mills.

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Organochlorines persist long in soils, water, plants and animal waste, and despite their low solubility in water, they are highly toxic. The use of organochlorines (eg.D.D.T) for control of pests is generally banned now, except for a few items such as Aldrin and BHC. The Committee noted that even this use of these organochlorines will be replaced in the near future as pests are becoming resistant to them. However, the Committee noted that organochlorines used in the past both for control of agricultural pests and for control of the malaria mosquito will persist in the soil and will affect ground water to some extent. Studies done by the Department of Agriculture have identified organochlorine insecticide residues in vegetables, hulled rice, canned pineapple, export products like tea and tobacco, and in human fat and milk samples.

Organophospates like Diazinon and Malathion are also highly toxic, but they degrade relatively in biological systems. Their solubility however is higher/than organochlorines, and they move great distances underground compared to organochlorines. However, they may not be a serious threat to water pollution due to their being less persistent and fast degrading.

The third category of pesticides are the Carbamates, like Carbofuran. These are relatively new and not much is known about their behaviour in the ground. However they are less persistent in the environment like organophosphates. A list of pesticides presently recommended for agricultural crops was also available to the Committee. While the recommended list is 53, the Committee noted that in a survey done in 1980, a total of 115 chemicals were available. The Department of Agriculture also provided a table showing surface water criteria for permissible pesticides in public water supplies. This table is at Annex VI.

2.2.2 The Committee noted that agricultural pollution of water sources could take the following forms.

(a) Addition of untreated sewage and waste water containing human and animal excreta which could cause various water-borne diseases.

(b) Addition of agro-chemicals.

(c) Addition of readily degradable organic matter which result in exhaustion of dissolved exygen.

iii) Medium level of pollution - e.g. manufacture of oil paints, polishes, synthetic textiles, confectionary, plastic goods, ball point pens, aluminium ware, mirrors etc.

iv) Higl level of pollution - e.g.

(a) Food and beverage processing industries such as canning, dairy products, brewed and distilled beverages, meat, poultry and fish products, sugar and molasses.

(b) Textile and leather processing industries such as dyeing, bleaching, leather tanning etc.

(c) Chemical industries such as torch batteries insecticides, starch processing, pigments, paints, etc.

(d) Material industries such as paper and pulp, metal plating, rubber and latex, iron foundry products, photographic products, iron, steel etc.

The Committee considers that all industries should be clasified under these for heads for the purpose of pollution control, and that this classification should be noted in siting industries as well as in implementing measures for pollution control of drinking water sources.

2.2. Agriculture pollution

2.2.1 Studies previously done

The Committee examined some of the studies already done on agricultural pollution of drinking water sources. In one study carried out recently in areas like Matale it has been found that even though D.D.T. has not been in use for several years, traces of D.D.T. have been found in well waters. Studies have revealed that some farmers in vegetable growing areas as N'Eliya and Jaffna use more than the recommended dosages of pesticides, and that such pesticides may enter ground water by percolation, as well as from surface water close to the farms.

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2.2.3 Taking into consideration the studies done in agricultural pollution, the Committee noted the following points -

(a) Control of the excessive use of pesticides at the farm level through legal measures is impracticable, and other methods such as farmer education have to be used;

(b) Control of agricultural pollution could be effectively implemented by controlling imports of agricultural chemicals under the Control of Pesticides Act. No. 33 of 1980.

(c) In order that studies could be undertaken at farm level for more effective results in controlling agricultural pollution it is desirable that the number of chemicals imported should be reduced to the barest minimum essential.

2.3. Pollution by Human settlements

2.3.1. The Committee noted that pollution of drinking water sources is caused by human settlements. The forms of pollution here are

(a) Addition of untreated sewage which cause various water-borne diseases like cholera, typhoid, dysentry etc.

(b) Addition of readily degradable organic matter like Carbohydrates, proteins etc. contained in domestic and farm wastes. These directly affect the dissolved oxygen in the water and thereby reduces its self-purifying ability.

(c) Addition of storm water run-offs from settled area.

2.3.2. The Committee considered that control of pollution by human settlements has to be examined in the following background -

(a) Generally it could be considered to rank lower in priority than industrial and agricultural pollution.

(b) A considerable amount of subsidiary ligislation is already available to control such pollution and these are being implemented by Local Authorities.

3. STANDARDS

3.1. The Committee examined the standards adopted in several countries, both developed and less developed for industrial effluents which are the major source of pollution of

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drinking water. In particular the Committee examined the Indian standards, and considered that these could be adopted in Sri Lanka with certain modifications.

3.2. Standards examined were those for industrial effluents for discharge

(a) Into inland surface waters ;
(b) Into public sewers;
(c) Into marine coastal waters;
(d) Onto land for irrigation purposes;

In the case of effluents to be used for irrigation purposes, the Committee noted that many parameters were omitted here, so that ground water could be polluted. The Committee however noted that already about 1 m. gallons per day of effluent, from the Valachchenai Paper Factory appear to be used for irrigation purposes and that this could be applied at Embilipitiya as well. It was therefore decided that a suitable standard should be worked out by the C.E.A. for effluent discharged on land for irrigation purposes.

3.3. In considering the application of standards the Committee noted the importance to be attached to enforcement. If standards are to be enforced there must be laboratory and other facilities to test whether samples clllected conform to standards. The Committee therefore considered that the facilities available in various institutions for testing samples on these standards should be examined, and that the facilities lacking should be provided.

3.4. In connection with the implementation of standards the Committee noted that the CISIR will be setting up a separate unit for study of environmental pollution. This unit will be carrying out analyses of effluent samples and also undertaking surveys of environmental pollution.

3.5 Standards for effluents discharged into inland surface water

3.5.1 The following permissible limits for industrial effluents discharged into inland surface waters, which are based on Indian standards with a few modifications are recommended.

Characteristic	Tolerance limit
1. Total suspended solids, mg/1 Max.	100
2. Particle size of total suspended solids	Shall pass 850 micron 15 seive
3. P^H	5.5 - 9.00
4. Temperature	Shall not exceed 40°C in any section of the stream within 15 meters downstream from the effluent outlet.
5. Biochemical Oxygen Demand for 5 days at 20°C mg/1 Max	30
6. Oils and Grease, mg/1 Max.	10
7. Phenolic Compounds, mg/1 Max.	1.0
8. Cyanides (as CN), mg/1 Max.	0.2
9. Sulphides (as S), mg/1 Max.	2.0
10. Insecticides	Absent
11. Total Residual Chlorine, mg/1 Max.	1.0
12. Fluorides (as F), mg/1 Max.	2.0
13. Arsenic (as As), mg/1 Max.	0.2
14. Cadmuim (as Cd), mg/1 Max.	0.1
15. Hexavalent Chromium (as Cr), mg/1 Max.	0.1
16. Copper (as Cu), mg/1 Max.	3
17. Lead (as Pb), mg/1 Max.	0.1
18. Mercury (as Hg), mg/1 Max.	0.0005
19. Nickel (as Ni), mg/1 Max.	3.0
20. Selenium (as Se), mg/1 Max.	0.05
21. Zinc (as Zn), mg/1 Max.	5
22. Ammoniacal Nitrogen, mg/1 Max.	50
23. Chemical Oxygen Demand, mg/1 Max.	250
24. Radio Active Materials:	
a) Alpha emitters/^{u}c/ml Max.	10^{-7}
b) Beta emitters/^{u}c/ml Max.	10^{-6}

3.5.2 The Committee decided that the task of preparing the relevant standards should be entrusted either to the Bureau of Sri Lanka Standards or to a special drafting committee appinted by the CEA.

Notes on above standards

(1) The above standards apply only when the dilution is 8 volumes of clean receiving water to 1 volume of effluent. The dilution factor shall be calculated from the average low - flow of the river and the average waste water discharge. If the dilution of the effluent is different from 1 to 8, the permissible limits can be changed by multiplying them with 1/8 of the actual dilution.

(2) No increase in the permissible limits for these items is to be allowed as a result of increased dilution of the effluent beyong 1 to 8.

(3) Metals - These substances have an additive effect. If more than one of them is present at the same time, percentage value should be calculated individually for each substance from the actual concentration and the permissible limits. The sum of the percentages should not exceed 100%. For example, if an effluent contains .06 mgs/1 of Cd(namely 60% of the permissible limit)and .04 mgs/1 of Chromium (namely 40% of the permissible limit), there is no scope for allowing other metals, since the total of the above two metals already equals 100%.

3.6 Standards for effluents discharged into public sewers

3.6.1 The following standards based on Indian standards are recommended for discharge of effluents intp public sewers

Characteristic	Tolerance Limit
1. P^H	5.5 to 9.0
2. Temperature, mg/1 Max.	45^oC
3. Suspended Solids, mg/1 Max.	600, relaxable to 750 by the local authority
4. Biochemical Oxygen Demand, for 5 days at 20^oC, mg/1 Max.	500, subject to relaxation or tightening by the Local Authority.
5. Oils and Grease, mg/1 Max.	100
6. Lead (as Pb), mg/1 Max.	1
7. Copper (as Cu), mg/1 Max.	3
8. Zinc (as Zn), mg/1 Max.	15
9. Hoxavalent Chromium (as Cr) mg/1 Max.	2

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Characteristic	Tolerance Limit
10. Nickel (as Ni), mg/1 Max.	2
11. Cyanide (as CN), mg/1 Max.	2.0
12. Phenolic Compounds (as C_6H_5OH) mg/1 Max.	5 relaxable to 80 by the local authority when secondary treatment of sewage is carried out.
13. Alpha emitters, ^uc/ml. Max.	10^{-7}
14. Beta emitters, ^uc/ml. Max.	10^{-6}
15. Ammoniacal Nitrogen (as N)	50

3.6.2. For the preperation of the relevant standards, action will have to be taken as recommended at paragraph 3.5.2

3.7 Standards for effluents discharged into marine coastal waters

3.7.1 The following standards based on Indian standards with slight modifications are recommended for discharge of effluents into marine coastal waters -

Parameter	Values not to be exceeded
1. Biochemical Oxygen Demand (BOD) (5 days at 20 °C) mg/1	50
2. Total suspended solids	
a) For process waste water, mg/1	100
b) For cooling water effluent	Total suspended matter content of influent cooling water plus 10 percent.
3. Particle size of:	
a) Floatable solids, Max.	3 mm
b) Settleable solids, Max.	850 microns
4. Temperatures, Max.	45^oC at the point of discharge.
5. P^H value	Between 6 and 8.5
6. Oils and grease, mg/ Max.	20
7. Ammoniacal Nitrogen (as N) mg/1 Max.	50
8. Residual Chlorine, mg/1 Max.	1

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Parameter	Values not to be exceeded
9. Fluorides mg/1 (As F), Max.	15
10. Cyanides (as CN), mg/1 Max.	0.2
11. Phenolic Compounds (as C_6H_5OH) mg/1 Max.	5
12. Sulphides (as S), mg/1 Max.	5
13. Arsenic (as As), mg/1 Max.	0.2
14. Selenium (as SE), mg/1 Max.	0.05
15. Pesticides	
a) Organo-phosphorous Compounds (as P), mg/1 Max.	1
b) Chlorinated Hydrocarbons (as Cl), mg/1 Max.	0.0
16. Copper (as Cu) mg/1 Max.	3.0
17. Lead (as Pb), mg/1 Max.	1.0
18. Chromium (as Cr), mg/1 Max.	1.0
19. Cadmium (ad Cd) mg/1 Max.	2.0
20. Mercury (as Hg) mg/1 Max.	0.01
21. Nickel (as Ni) mg/1 Max.	5.0
22. Zinc (as Zn) mg/1 Max.	5.0
23. Radioactivity:	
Alpha emitters, micro-curies/millilitre, Max.	10^{-8}
Beta emitters, microcu-ries/millilitre, Max.	10^{-7}
24. Colour and Odour.	No visible colour or unpleasant odour.

3.7.2 For the preperation of the relevant standards, action will have to be taken as recommended in paragraph 3.5.2.

4. Legal Provisions and Enforcement

4.1 The Committee examined the existing legal provisions to control pollution of water sources and the methods being used now for this purpose.

4.2 Existing legal provisions

4.2.1 The Committee noted the following legal provisions related to pollution of water sources, viz

a) N.W.S.& D.B. law No. 2 of 1974 - sections 28,29, 35,37.

b) Urban Councils Ordinance - sections 103,114,127, 157(9), (12), etc.

c) Municipal Councils Ordinance.

d) Development Councils Act. No. 35 of 1980.

e) National Environmental Act. No. 47 of 1980.

f) Urban Development Authority Act No. 41 of 1978.

g) G.C.E.C. Act.

h) Crown Lands Ordinance, Chapter 454 - section 72.

i) Irrigation Ordinance.

j) Control of Pesticides Act No. 33 of 1980.

The Committee requested the Legal Consultant of the My/L.G., H&C to examine these and other existing legal provisions to find out their adequacy for control of pollution of water sources and to suggest additional legal provisions that would be required, in the light of what was discussed in the preliminary report. His observations are noted below -

"The National Environmental Act No. 47 of 1980, established the Central Environmental Authority to make provision, inter-alia for the protection and management of the environment. This is the preamble to the Act itself. The powers, functions and duties of this Authority are very comprehensive and wide in scope. On the face of it, it may appear that these powers, functions and duties relate only to the setting up of standards and not the enforcement. I am however of the view that if the provisions of this Act are properly interpreted and effectually implemented we could still achieve the desired results without having to set up another Special Authority which would in effect fuplicate and over-lap the functions of the Environmental Authority itself.

Amongst the many powers, functions and duties of the Authority, there is provision for determining the criteria, uses, values, quality to be maintained, the extent of discharges in respect of protection and management of the environment. Further this Authority has the power to specify standards and norms and to undertake investigations and inspections to ensure compliance with such specified standards, norms and criteria and also in relation to non-complaince of same, calling for information with regard likely pollution of the environment, etc.

Though this Authority is based in Colombo there is provision for decentralisation of its powers, duties and functions by the delegation to District Environmental Agencies, giving such Agency such powers to enable them to be as effectual as the Central Authority itself.

It is also pertinent to note that under the Act, this Authority may from time to time give to any local authority such directions, special or general, to do or cause to be done any Act or thing which the Authority deems necessary for safeguarding and protecting the Environment within the local limits of such local authority. The compliance with such directions by the local authority is obligatory under the Law.

Further the words: 'environment' and 'pollution' in this Act adequately cover water and other areas and aspects concerning the Committee.

This particular Act is still in its stage of infancy: hence the apparent inadequacy. I firmly believe that with the passage of time, the proper understanding of the provisions and upon maturity of the Central Environmental Authority, we would achieve our objectives in full".

4.3 As regards enforcement, the Committee noted that the control exercised by the Ministry of Industries and Scientific Affairs is minimal so far as industrial pollution is concerned. In the application to set up a new industry, a very general question is asked as to whether such industry is likely to cause pollution and the nature of such pollution. In the case of the G.C.E.C. however there is a comprehensive form to be filled up by a new industrialist, and this covers the pollution effects to some extent. This amount of control is possible because the G.C.E.C. also functions as a local authority. In the case of the local authorities there is some degree of control of pollution, but this is insufficient to control pollution of water sources. Enforcement by the Central Environmental Authority has still to be tested. The Pesticides Act gives comprehensive coverage to matters connected with pollution by agricultural chemicals. However, it has not been possible so far to enforce these provisions adequately.

4.4 On the methods for exercising controls over pollution of water sources, the Committee considered that control of agricultural pollution has to be done primarily through the control of imports, and that at the farm level this control will have to

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be limited to extension and educational methods. In the case of pollution by human settlements the Committee considered that the local authority ordinances contain suitable provisions which could be improved based on the experience gained so far. However, it was noted that in the implementation of these provisions by local authorities the desired emphasis does not appear to have been given for prevention of pollution of water sources. In the case of industrial pollution, the Committee considered that this is the major cause of pollution in a given area, and that controls could be exercised more easily than in the case of agricultural pollution caused by a large number of farms. However, the Committee noted that control of industrial pollution through enforcement of legal provisions has been insignificant in the past. Even the controls exercised by local authorities have not given much weight to pollution of water sources. The Committee therefore was of the view that special provisions should exist for control of pollution of water sources in general and control of pollution of such water sources by industrial effluents in particular. These provisions should include powers to examine production processes and to enter factories for this purpose. There should also be provisions to stipulate conditions and standards for pre-treatment of effluent in the factory.

4.5 On the enforcement of measures to control pollution the Committee also considered the siting of factories in zones with reference to pollution hazards. Details of such zoning could be worked out, considering also the possibility of locating certain industries in parts of the country where the pollution hazard could be minimised.

5. RECOMMENDATIONS

1. In bringing measures for control of industrial pollution the following should be taken into consideration -

   (a) Industrial development should not be unduly hampered by the controls brought on industrial pollution.

   (b) The institutional arrangements and the facilities available for implementing any system of controls effectively must be taken into account.

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(c) The possibility of siting industries in certain areas where their pollution impact is minimised, and the application of pollution standards less stringently in such cases should be considered.

(d) It is desirable to commence with standards that are at a minimum consistent with safety of drinking water source.

2. Industries should be classified under the four heads discussed in paragraph 2.1.4., and this classification should be noted in siting industries as well as in implementing measures for pollution control of drinking water sources.

3. In consideration of measures to control agricultural pollution of water sources, the following should be taken into account -

(a) Control of the excessive use of pesticides at the farm level through legal measures is impracticable, and other methods such as farmer education have to be used.

(b) Control of agricultural pollution could be effectively implemented by controlling imports of agricultural chemicals under the Control of Pesticides Act No. 33 of 1980.

(c) In order that studies could be undertaken at farm level for more effective results in controlling agricultural pollution it is desirable that the number of chemicals imported should be reduced to the barest minimum essential.

4. The control of pollution of water sources arising from human settlements ranks lesser in priority then industrial and agricultural pollution, and a considerable amount of subsidiary legislation is already available for implementation by Local Authorities. The emphasis here has therefore to be on measures for proper enforcement, which include staffing and testing facilities.

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5. There should be standards for industrial effluents discharged into -

(a) Inland surface waters
(b) Public sewers.
(c) Marine coastal waters.
(d) Land for irrigation purposes.

These standards should be prepared by the Bureau of Sri Lanka Standards or a special drafting committee appointed by the Central Environmental Authority.

6. The provisions of the National Environmental Act No. 47 of 1980 should be examined by the Attorney General's Department to find out whether adequate provisions exist for control of pollution of water sources and enforcement of standards by the C.E.A. as indicated in paragraph 7. If the existing provisions of the Act are inadequate for this purpose, it is recommended that this Act be suitably amended.

7. For the control of pollution of water sources and for the enforcement of standards in respect of effluents the Committee considers that the following powers should be available with the C.E.A. -

(a) The authority to issue orders and directives to industrial and other establisnments that have an impact on environmental pollution to:

i) Submit plans and production processes involved and any other information relevant to environmental pollution for examination by the C.E.A.or by an authority exercising such delegated powers prior to the setting up of an industrial establishment:

ii) Require a proposed industrial establishment to include adequate effluent treatment facilities in its plant:

iii) Agree that effluents from such establishments will conform to standards laid down.

iv) Provide necessary plant, equipment, materials and staff necessary to bring such effluent up to the standard laid down:

v) Keep such plant, equipment, etc. in good working condition:

vi) Operate such plant in such a manner as to ensure that all effluent from such establishment is brought to the required standard before being discharged on land, waterways or sewers :

vii) Allow staff of the C.E.A. or any of its delegates to enter such establishments, with or without prior notice, to take samples of effluent, to carry out any tests on such effluent, to examine the productio process or any part of it, to examine the manner in which effluent is accumulated and released, and to do any or all such other things as are necessary to satisfy the C.E.A. that the standards of effluent discharged can and do conform to stipulated standards;

viii) Stipulate the quantity or volume of effluents that could be discharged at any time of the day or any season or period of the year;

ix) Warn an establishment that unless the effluent is brought up to the approved standard within a specified time, the provisions of the law will have to be enforced.

x) Limit, suspend or cease production where effluent discharged by an establishment is found to be below the standard stipulated ;

xi) Pay compensation as determined by the C.E.A. where effluent below the standard is discharged on to land or water resulting in loss or damage to persons and institutions.

(b) The power to undertake necessary surveys and investigations.

(c) The power to lay down standards for effluents to be discharged or land, water and sewers.

(d) The power to delegate its authority to government departments and corporations and local government institutions and to require such institutions to exercise the delegated authority within their areas of authority according to directives issued by the C.E.A.

8. For the proper implementation of the powers envisaged above the Committee considers that the C.E.A. should make use of various government and local government institutions which already have powers under the relevant ordinances to control pollution of water sources. Any further powers could be delegated to such institutions. For the proper implementation of these powers the Committee also recommends that available laboratory facilities should be examined and fully used, and that any additional facilities required be provided.

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Annex I

Analytical Data concerning effluent from certain factories (provided by C.I.S.I.R.)

Parameter	Milk Processing factory Effluent	Paper & Pulp Processing factory effluent	Milk Powder manufacturing factory effluent	Textile mill effluent	Paint factory Effluent
P^H	5-11	5.5-6.5	5-11	7 -11	11.5
Temp °C	30-50	33	30-50	30 -50	-
COD mg/l	2100-5400	2750	80-8000	400--3000	300-550
BOD_5 mg/l	2000-3800	1150	-	-	-
TS mg/l	100-2100	3700-4100	100-5000	-	-
Nitrogen mg/l	180-900	0.2	-	-	-
Phosphorus mg/l	0.2-15	-		-	-
Lead mg/l	-	1.0	-	-	-
Chlorides mg/l	-	100	-	-	-
Sodium mg/l	-	400	-	-	-
Oil & Grease mg/l	-	-	-	70 -800	150-1750
Dissolved O_2 mg/l	-	-	-	-	-
Faecal coliforms per 100 ml	-	-	-	-	-
Volume litres/day	0.45 m.	4.5 m.	0.225 m.	-	-

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Annex II

Water Quality of Puthueli Aru Valaichchenai
(29th April - 3 May 1980)
(Provided by CISIR)

Sampling Point	Distance downstreams km	p^H	Temp °C	TS mg/l	BOD mg/l	COD mg/l
1. Main effluent outlet	0	6.5	33.0	4030	1150	2750
2. Puthuveli Bridge	1.2	6.5	32.5	2770	950	2230
3. Downstream from Puthuveli Bridge	3.8	6.5	35.0	9910	620	1050
4. Offamavadi Bridge	6	6.5 -7.0	34.0	27,100	15	91

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Water Quality of the Wellawatte Canal as At 11th February, 1981. (Provided by CISIR)

	SAMPLE NUMBER					
	1	2	3	4	5	6
Collection Time	09.35	09.50	10.15	10.40	11.25	12.0
Temperature ^{o}C	29.0	28.5	27.2	28.5	29.0	29.0
pH	5.5	6.0	6.0	6.0	5.5	6.0
Dissolved Oxygen mg/l	5.9	3.2	N.D	2.3	1.5	0.7
BOD_5 mg/l	7.8	10.5	40.8	7.0	18.5	31.4
Total Solids (mg/l)	82	100	117	158	173	128
Suspended Solid (mg/l)	8	4	30	12	8	6
E.Coli per 100 ml (MPN)	Nil	23	1100+	1100+	1100+	1100+

SAMPLES

1) Cotta Road under the bridge

2) Nawala-Nugegoda Road under the bridge

3) Nawala-Narahenpita Road, near the bridge

4) Under the Railway bridge Narahenpita

5) Havelock Road under the bridge

6) Under the Railway bridge Wellawatte.

Water quality of Kelani River as at 16th March 1982

(Provided by CISIR)

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10
bidity	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
ur	No odour	No odour	No odour	No odour	No odour	No odour	No odour	No odour	No odour	No odour
our (Hazen units)	10	10	15	15	15	15	15	15	15	15
t 25°C	6.4	6.4	6.4	6.4	6.3	6.3	6.2	6.5	6.5	6.5
ductivity at 25°C (micros/cm3)	6000	4600	3200	55	50	35	51	35	50	40
.D. $_3$ (mg/1)	0.2	0.1	3.3	0.9	0.1	2.4	4.4	8.2	1.4	0.9
.D. (mg/1)	4.3	3.4	3.0	5.9	5.5	5.7	5.5	3.9	3.1	5.4
al solids at 180°C (mg/1)	3850	3018	2087	60	47	40	35	21	48	28
pended solids at 105°C (mg/1)	45	53	31	43	20	11	17	15	22	13
al hardness as $CaCO_3$ (mg/1)	681	516	338	19	10	20	20	19	13	20
oride as Cl (mg/1)	1861	1435	839	9	43	17	35	17	9	35
ica as SiO_2 (mg/1)	5	5	6	6	8	8	8	8	8	8
sphate as P_2O_5 (mg/1)	0.1	0.4	0.1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
n as Fe(mg/1)	0.5	0.6	0.5	0.6	0.3	0.4	0.5	0.3	0.5	0.5
rate as N (mg/1)	5	4	3	1	1	1	1	0.9	0.9	1
e ammonia as NH (mg/1)	0.06	0.07	0.07	0.05	0.05	0.03	0.07	0.04	0.11	0.04
uminoid ammonia as NH_3 (mg/1)	0.14	0.12	0.09	0.13	0.12	0.11	0.08	0.05	0.09	0.20
and grease (mg/1)	33	28	27	25	40	25	28	31	33	25
ium (mg/1)	1600	800	700	2	2	2	2	2	2	2
phate (mg/1)	152	135	144	N.D	N.D.	N.D.	N.D.			
al bacterial count per ml x1000	960	280	310	13	22	144	61	675	29	3,000
al Coliforms per 100 ml	3330	1350	245	85	35	60	Nil	150	60	70

Water Quality of Kelani River as at 16th Narch 1982

pling Points:

Mattakkuliya estuary

Madampitiya downstraem from old bridge

Sedawatte under new bridge

4. Kalaniya - about 30 m downstream from Petroleum refinery outlet.
5. About 20 m upstrem from Petroleum refinery outlet
6. About 60 m upstrem from Petroleum Refinery outlet
7. Bollegala-near Fertilizer Corporation
8. Bandarawatte ferry crossing
9. Malwana
10. Kelaniya opposi Temple

INDUSTRIAL POLLUTION IN JA-ELA - EKALA AREA

(Provided by the NARA)

In the present study water samples were collected from seven stations in the area under study, the main areas visited being Thudella and Kurunduwatta. Samples were collected from the following centres

Test	CONTROL SAMPLE	STATION (1)	STATION (2)	STATION (3)	STATION (4)	STATION (5)	STATION (6)	STATION (7)
1. Colour	Colourless	Light orange brown	Light brown green	black blue	black	blue yellow	blue yellow	yellow green
2. Odour	No special odour	slight sulfide smell	Lubricant oil smell	Strong sulpher	Sulpher dioxide smell	Slight sulfide smell	Sulfide smell	Sulfide smell
3. Velocity of flow	-	very slow flow	very slow flow	very slow flow	Stagnant	Stagnant	Stagnant	Stagnant
4. Turbidity	0.0. NTU	20 NTU	18 NTU	55 NTU	59 NTU	36 NTU	37 NTU	22 NTU
5. PH	6.9	7.71	5.91	5.4	5.8	6.25	6.55	6.23
6. Temperature Air Water	27.4 C° 27.2 C°	29.5 C° 29.2 C°	29.1 C° 27.7 C°	29.6 C° 32.4 C°	29.7 C° 29.0 C°	29.2 C° 28.3 C°	31.4 C° 31.0 C°	31.4 C° 29.8 C°
7. Salinity	0 %	0 %	1 %	10 %	15 %	5%	5%	3%
8. Conductivity	80 MHOS	135 MHOS	155 MHOS	1100 MHOS	1500 MHOS	360 MHOS	315 MHOS	198 MHOS
9. Suspended Solids	0.009/L	0.704/L	0.67/L	1.25/L	1.85/L	1.03/L	1.04/L	0.802/L
10. Amount of dissolved Oxygen	1.4 mg/L	1.2 mg/L	1.0 mg/L	0.0 mg/L	0.0 mg/L	1.0 mg/L	0.2 mg/L	0.3 mg/L

Test	CONTROL SAMPLE	STATION (1)	STATION (2)	STATION (3)	STATION (4)	STATION (5)	STATION (6)	STATION (7)
11. Nitrate	0.23 mg/L	1.0 mg/L	1.93 mg/L	1.87 mg/L	1.90 mg/L	1.97 mg/L	1.85 mg/L	1.71 mg/L
12. Amount of Oil or grease present	0 gm/L	0.0395 gm/L	0.0425 gm/L	0.105 gm/L	0.099 gm/L	0.027 gm/L	0.089 gm/L	0.079 gm/L

The following sampling sites were selected

1. Station I - Thudella ATCO Factory (A)
2. Station II - Thudella CTB Depot (B)
3. Station III - Kurunduwatta - Textile processing Industries (C)
4. Station IV - Kurunduwatta - Water logged stream opposite the Textile Processing Industries (C)
5. Station V - Kurunduwatta - about 4 k.m. down the polluted stream (C)
6. Station VI - Kurunduwatta - Alexandra/Cyntex Garment Factories (D)
7. Station VII - Kurunduwatta - Alexandra and Cyntex Garment Factories about 2 k.m. down the polluted stream

Annex VI

Surface Water Criteria for Permissible Pesticides in Public Water Supplies

(pp 10^6) (mg/1)

(Provided by Department Agriculture)

Pesticide	Permissible criteria	Desirable criteria
Aldrin	17	Absent
Chlordane	3	Absent
DDT	42	Absent
Dieldrin	17	Absent
Endrin	1	Absent
Heptachlor	18	Absent
Heptachlor epoxide	18	Absent
Lindane	56	Absent
Methoxychlor	35	Absent
Organo phosphates plus carbemates	100	Absent
Toxaphene	5	Absent
2,4-D plus 2,4, 5-T and 2,4,5-TP	100	Absent